2012 DRY BEAN YIELD TRIALS

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The bean breeding program initiated its fourth season on the new 320 acre research farm, Saginaw Valley Research & Extension Center (SVREC) near Frankenmuth in 2012. A total of 3,900 yield trial plots (24 tests) in 2012 and 1,977 single plant selections were made in the early generation nurseries. Yield trials at SVREC (Richville) included 56-entry standard navy test; two 36-entry standard black tests; 80-entry prelim navy tests; 42-entry prelim black test; 36-entry standard GN; 36-entry standard pinto test; 30-entry standard red/pink test; 16-entry prelim GN test; 90-entry prelim red/pink test; 16-entry FM test; 16-entry yield gain navy test; 20-entry yield gain pinto test; two 96-entry drought trials and 42-entry Co-op and regional test that includes pinto, GN, red and pinks. At Montcalm 64-entry bush cranberry test; 56-entry kidney test; 56-entry preliminary kidney test; 5-entry mayacoba test; 64-entry white mold test; 130-entry nitrogen fixation (BNF) test on campus; and two 36-entry certified organic trials in Tuscola county. All trials were direct harvested except for kidney, cranberry, drought, BNF and white mold trials that were rod pulled to measure plant biomass. Dry weather early in the season followed by ample rainfall delayed maturity at Frankenmuth but yields were above average. Plots at Montcalm had similar rainfall pattern but the stress was offset with supplemental irrigation and excellent yields were recorded in the kidney and cranberry trials. Screening for resistance to common bacterial blight (CBB) was very effective in these nurseries. White mold infection developed well in 2012 and genotypic differences were observed. Yield in cranberry beans approached 40 cwt and many lines with resistance to CBB were identified in both kidney and cranberry nurseries. Rust is becoming an increasing threat to navy, black and small red bean producers in Michigan, and we have identified resistance to race 22:2 in new navy, black and small red bean lines. In the drought and BNF trial plant biomass was determined on all plots prior to threshing. Root measurements were taken on the drought plots in Frankenmuth at flowering by digging plants and following protocol termed Shovelomics to measure root diameter, angle and vigor traits that may play a role in tolerating drought.

The season in Frankenmuth started out with limited rainfall following planting and only 0.2" fell during the first month through early July. Two sustaining rains of approximately 0.5" fell on July 3 and 18, followed by a major 2.0" rain on July 26/27. The crop maker was a rain of 2.4" on Aug 10/11which resulted in an overall summer rainfall of 2.53" lower than the 30-year average. The drought reversed maturities with full-season black and navy beans maturing ahead of pinto and great northerns. As a result of the early drought, many of the early-season lines double-set, whereas the longer-season blacks and navies matured normally ahead of pinto, and great northern trials. Many of the pinto, great northern and small red lines lost upright plant structure as a result of the regrowth making them difficult to harvest and reducing yields. The pink lines matured normally under these conditions and out-yielded the small red lines. Plots at Montcalm had more rainfall but the stress was offset with supplemental irrigation and excellent yields over 35 cwt/acre were recorded in the kidney and cranberry trials. White mold infection developed well in 2012 and exceeded the low levels observed in 2011.

The data for all tests are included in an attached section. Procedures and details on nursery establishment and harvest methods are outlined on the first page. Since the data collected on each test are basically the same, a brief discussion of each variable measured is presented below for clarification purposes.

1. Yield is clean seed weight reported in hundredweight per acre (cwt/acre) standardized to 18% moisture content. Dry beans are commercially marketed in units of 100 pounds (cwt).

2. Seed weight is a measure of seed size, determined by weighing in grams a pre-counted sample of 100 seeds, known as the 100-seed weight. To convert to seeds per 100g (10,000/100 seed wt); for example 100-seed weight of 50 converts to 200 seeds per 100 g (used in marketing).

3. Days to flower is the number of days from planting to when 50% of plants in a plot have one or more open flowers.

4. Days to maturity is the actual number of days from planting until date when all the plants in a plot have reached harvest maturity.

5. Lodging is scored from 1 to 5 where 1 is erect while 5 is prostrate or 100% lodged.

6. Height is determined at physiological maturity, from soil surface to the top of plant canopy, and is recorded in centimeters (cm).

7. Desirability score is a visual score given the plot at maturity that takes into consideration such plant traits as; moderate height, lodging resistance, good pod load, favorable pod to ground distance, uniformity of maturity, and absence of disease, if present in the nursery. The higher the score (from 1 to 9) the more desirable the variety, hence DS serves as a subjective selection index.

At the bottom of each table, the mean or average of all entries in a test is given to facilitate comparisons between varieties. In order to better interpret data, certain statistical factors are used. The LSD value refers to the Least Significant Difference between entries in a test. The LSD value is the minimum difference by which two entries must differ before they can be considered significantly different. Two entries differing in yield by 1 cwt/acre cannot be considered as performing significantly different if the LSD value is greater than 1 cwt/ acre. Such a statement is actually a statement of "probable" difference. We could be wrong once in 20 times ($p=0.05$) on the average, depending on the level of probability. The other statistic, Coefficient of Variation (CV), indicates how good the test was in terms of controlling error variance due to soil or other differences within a location. Since it is impossible to control all variability, a CV value of 10% or less implies excellent error control and is reflected in lower LSD values. Under the pedigree column, all released or named varieties are **bolded** and always preceded by a comma (,); when preceded by a slash (/), the variety was used only as a parent to produce that particular breeding line.

Expt. 2101: Standard Navy Bean Yield Trial

This 56-entry trial included standard commercial navy bean varieties, and advanced lines from the MSU breeding program, which carry the N-prefix. Yields ranged from 16.9 to 28.4 cwt/acre with a mean of 23.2 cwt/acre. The trial was fairly uniform and variability was well controlled (CV=11.7%) and the LSD needed for significance was 3.2 cwt/acre. Seven entries significantly out-yielded the test mean and included the Merlin variety from Coop Elevator. The group included N11283 that showed potential in 2011 and continues to perform well as did its sib N11284. Other lines of note are an early season line N11277 that dried down well. Varieties Rexeter, Medalist, Vista and Indi were all mid pack in terms of performance. Canning tests will be conducted on all MSU breeding lines before being considered for release. Overall performance of this test was disappointing compared to other seed classes as many of the lines did not mature well, remained green and exhibited the seed and pod infertility problem associated with the 'green spot' syndrome in this section of the farm.

Expt. 2102: Standard Black Bean Yield Trial

This 36-entry trial included the standard commercial black bean varieties and advanced breeding lines. Yields ranged from 24.1 to 35.6 cwt/acre with a test mean of 31 cwt/acre, significantly exceeding the yield potential of the advanced navy trial 2101. Variability was low in this test, (CV=7.5%) and the LSD was 2.7 cwt/acre. Seven entries significantly outyielded the test mean and these included Loreto. Zorro fell outside this group but was significantly higher yielding that Jaguar, Eclipse, Shania, Black Velvet, and T-39. The top yielding entry B10244 was the top yielder in 2011 and showed similar potential in 2012 with excellent combination of erectness, dry down and superior canning quality.

Expt. 2103: Standard Black Bean Yield Trial

This 36-entry trial included newer B11-black bean lines and check varieties compared to older entries in test 2102. Yields ranged from 23.2 to 34.5 cwt/acre with a mean of 28.9 cwt/acre. Variability was low in this test (CV=7.6%) and the LSD was 2.6 cwt/acre. Six lines significantly outyielded the test mean and these included Zorro which significantly outyielded Eclipse and Shania. The MSU lines have low DS scores but they carry additional disease resistance for CBB, rust and anthracnose so future advances of many of these lines will largely depend on canning quality of the entries.

Expt. 2104: Preliminary Navy Bean Yield Trial

This 80-entry trial included new navy bean lines and check varieties. Yields ranged from 15.1 to 34.1 cwt/acre with a mean of 23.8 cwt/acre. Variability was low in this 3-rep test (CV=7.7%) and the LSD was 2.5 cwt/acre and overall yields were better than advanced navy trial 2101. Twenty-five lines including Merlin and Indi significantly outyielded the test mean. Vista and Medalist were equivalent to the test mean. The top yielding entry was N11283 that was almost 3 cwt better than the second entry, underscoring its yield potential. It was 11 cwt better than its parent, Medalist. Future advances of many of the new breeding lines will largely depend on disease reactions and canning quality of the entries.

Expt. 2105: Preliminary Black Bean Yield Trial

This 42-entry trial included new black bean lines and check varieties. Yields ranged from 17.2 to 32.1 cwt/acre with a mean of 25.7 cwt/acre. Variability was moderate in this 3-rep test (CV=10.6%) and the LSD was 3.7 cwt/acre. Ten lines significantly outyielded the test mean and the top yielding entry B10244 was the same entry in test 2102. The two top entries were older lines not the newer lines with B12-prefix. Interestingly three groups of sibs fell in this group suggesting their high yield potential and consistent performance. The two checks, Shania and Zorro were similar in the mid group. Many of these lines carry anthracnose resistance but future advances of any new breeding lines will largely depend on confirmation of disease reactions and canning quality of the entries.

Expt. 2106: Navy Bean Genetic Gain Yield Trial

This small 16-entry trial included a group of old and new navy bean varieties to compare yield gain over the last century. Yields ranged from 17.4 to 26.8 cwt/acre with a mean of 22.9 cwt/acre. Variability was low in this test (CV=8.5%) and the LSD was 2.8 cwt/acre. Five lines significantly outyielded the test mean and included only varieties released since 1982. The mid group included varieties with a mixed history from Michelite (1938) to T9905 (mid 2000s). The last group had many determinate varieties but the major surprise was the overall poor performance of Avalanche released in 2010 in North Dakota.

Expt. 2107: Standard Great Northern Bean Yield Trial

This 36-entry trial included MSU great northern breeding lines (G-prefix) and standard commercial check varieties. The test ranged in yield from 14.0 to 32.1 cwt/acre with a mean yield of 25 cwt/acre. Variability was moderate (CV= 10.6%) resulting in a high LSD value (3.1 cwt/acre) needed for significance. Seven breeding lines significantly outperformed the test mean and included breeding line
G08254 under consideration for release. The second entry G08254 has been a top performer over the last four years and also significantly out-yielded the check variety Matterhorn which yielded similar to the test mean. In prior years a large number of lines exhibited severe 'fish-mouth' seed damage making them commercially unacceptable. This seed condition was not as obvious in 2012, but only those entries with larger seed size, improved dry seed quality and cracking resistance better than Matterhorn will be advanced in 2013. Similar to 2011, the maturity of GN lines was delayed due to the dry conditions and plants grew more vegetatively and lost some of their upright growth habit, exhibiting higher lodging scores (2.5-3.0) in 2012.

Expt. 2108: Standard Pinto Bean Yield Trial

This 36-entry trial included standard commercial pinto bean varieties and advanced breeding lines from the MSU breeding program with the P-prefix. The trial ranged in yield from 16.2 to 35.0 cwt/acre with a mean of 28.1 cwt/acre. Variability was low (CV=9.5%) in this trial and the LSD needed for significance was 3.1 cwt/acre. Nine entries significantly out-yielded the test mean and

these included the varieties Eldorado, La Paz, and Medicine Hat. Eldorado formerly tested as P07863 was the highest yielding pinto in the white mold trials in Montcalm in 2007 2008 and 2009 was 2nd in this test in 2010 and 1st in 2011. Pinto PT8-6 ranked second and shows potential. Other varieties Lariat exceeded the test mean whereas Santa Fe yielded at the bottom of the test Only those high-yielding entries with more upright architecture and canning quality equivalent to Othello will be advanced in 2012.

Expt. 2109: Standard Pink and Small Red Bean Yield Trial

This 30-entry trial included small red and pink breeding lines from MSU (R-S-prefix), in addition to standard commercial check varieties. The test ranged in yield from 21.6 to 31.4 cwt/acre with a mean yield of 26.7 cwt/acre. Variability was moderate (CV=10.2%) due to direct harvesting resulting in a LSD value (3.2 cwt/acre) for significance. Only four breeding lines including new Rosetta variety significantly outperformed the test mean. Sedona pink yielded above the test mean whereas, small red variety Merlot yielded significantly below the test mean. Merlot had an overall poor performance year combined with delayed maturity in many locations similar to 2011. Included in the test was the new small red variety Rio Rojo from NDSU that also performed below the test mean. The majority of small red lines were lower yielding and lack the canning quality of Merlot. Progress in small red breeding program has been limited by lack of useful variability.

Expt. 2110: Flor de Mayo, Flor de Junio Bean Yield Trial

This small 16-entry trial included new upright flor de mayo (FM) and flor de junio (FJ) bean lines along with check variety FM Eugenia from Mexico. This is the second year for this trial with FM/FJ lines bred for adaptation, upright architecture, yield and suitability for local production. Yields ranged from 18.3 to 33.6cwt/acre with a mean of 25.1 cwt/acre. Variability was moderate in this 3-rep test (CV=15.3%) and the LSD was 5.4 cwt/acre. As a result only one FJ line significantly out-yielded the test mean and it showed the overall best architecture traits. Lodging was very significant in this test as the plants produced excessive vegetative growth caused by the early season drought. The variety Eugenia was planted as a check for seed type and quality but it yielded at the bottom of the trial due in large part to poor adaptation. A few of top FJ/FM lines exhibited improved upright architecture, good dry down and high DS scores and future advances of these lines will largely depend on disease reactions, particularly to BCMV and the preferred color patterns of the dry FM/FJ seed.

Expt. 2111: Preliminary Great Northern and Otebo Bean Yield Trial

This small 16-entry trial included new great northern bean lines and otebo lines along with check varieties. Yields ranged from 16.0 to 31.5 cwt/acre with a mean of 24.3 cwt/acre. Variability was moderate in this 3-rep test (CV=10.3%) and the LSD was 3.5 cwt/acre. Four lines significantly out-yielded the test mean and these included three sibs from the same cross. New otebo lines in the G12900 series fell in the second group along with the Matterhorn check. These lines significantly outyielded the Fuji check variety. Future advances of many of the new breeding lines will largely depend on disease reactions and canning quality of the entries.

Expt. 2112: Preliminary Red and Pink Bean Yield Trial

This 90-entry trial included new small red and pink bean lines along with check varieties bred to ensure they had adequate levels of resistance to BCMV. Yields ranged from 10.3 to 36.7 cwt/acre with a mean of 29.1cwt/acre. Variability was moderate in this 3-rep test (CV=10.5%) and the LSD was 4.1 cwt/acre. Sixteen lines significantly out-yielded the test mean including the new pink variety, Rosetta and top yields at or above 35cwt were exceptional. Both checks Merlot and Sedona yielded below the test mean and Rio Rojo yielded above the test mean. This is the second season that Merlot has underperformed. The early drought in both years appears to have had a negative effect on Merlot, causing it to abort flowers, re-green, re-flower but never fully recover compared to other varieties. A number of top lines exhibited nice upright architecture, good dry down and high DS scores and future advances of many of the new breeding lines will largely depend on their reaction to BCMV, seed quality, color and canning quality of the entries.

Expt. 2113: Pinto Bean Genetic Gain Yield Trial

This small 20-entry trial included a group of old and new pinto bean varieties to compare yield gain over the last century. Yields ranged from 13.7 to 35.7 cwt/acre with a mean of 27.0 cwt/acre. Variability was low in this test (CV=9.7%) and the LSD was 3.6 cwt/acre. Six lines significantly outyielded the test mean and included a combination of both old and new varieties released since 1940s. The group included both old vine type-III and upright type-II varieties such as Lariat and Stampede. The mid group included varieties with a mixed history from the landrace common pinto to Sierra, first upright type-II (1989) and many of widely grown early-season varieties such as Othello. The major surprise was the overall poor performance of Buster which has been a consistent high performer over the years.

Expt. 2114: Combined Midwest Regional Performance Nursery (MRPN) & Cooperative Dry Bean Nursery (CDBN) Yield Trial

The MRPN is conducted annually in cooperation with North Dakota (ND-prefix), Nebraska (NE-prefix) and Colorado (CO-prefix) in order to test new pinto and great northern lines from all four programs and assess their potential in the different regions. The CDBN is a national trial and includes all classes but only medium-sized entries were included in this trial. The 42-entry trial ranged in yield from 16.1 to 36.0 cwt/acre with a mean of 25.2 cwt/acre. Variability was moderate (CV=10.6%) resulting in a LSD value (3.6 cwt/acre) for significance. As a result only five lines were significantly higher in yield than the test mean including the two new MSU varieties, Eldorado and Rosetta. Eldorado was the top yielding entry on the research farm in 2012. The top yielding entries were all pintos except Rosetta and included breeding line P08161 a line selected for resistance to potato leafhoppers. In the top group were pinto lines PT9-6 and a CO line from Colorado. The two new varieties Longs Peak pinto from Colorado and Rio Rojo from NSDU performed below the test mean. The longer-season vine cranberry varieties Bellagio were among the lowest yielding entries and do not perform at the level of pintos or great northern beans. As in test 2113, Buster was the lowest yielding entry suggesting that it does not tolerate drought stress. This cooperative trial continues to be valuable as it allows an evaluation of potential new lines prior to release in other states and confirmed performance of new MSU varieties released in 2012.

Expts. 2115 & 2116: BeanCAP Drought Yield Trials

Two 96-entry trials were conducted side by side one was irrigated and the other received only rainfall reported earlier in this report. The purpose of the trial was to evaluate drought stress on performance and root traits of diverse group of genotypes. Agronomic, yield, harvest index and root data were collected on both trials. The study is part of student research project supported by Beancap and USDA-NIFA grant. In the non irrigated trial, yields ranged from 14.2 to 36.7 cwt/acre with a mean of 27.3 cwt/acre. The trial was fairly uniform and variability was well controlled in this 3-rep test (CV=10.9%) and the LSD needed for significance was 4.0 cwt/acre. Fifteen entries significantly out-yielded the test mean and included varieties such as Eldorado, Kodiak, Medicine Hat, La Paz, Lariat, Orion, Shania and Othello two breeding lines PT7-2 and PR0340-3-3-1. The irrigated trial received supplemental water from two irrigations totaling 0.9" (7/23 and 8/3) and yields ranged from 16.3 to 34.1 cwt/acre with a mean of 26.0 cwt/acre. The trial was less uniform and variability in this 3-rep test was slightly higher (CV=11.2%) and the LSD needed for significance was 3.9 cwt/acre. Eleven entries significantly out-yielded the test mean and included some of the varieties such as Medicine Hat, La Paz, Lariat, Orion, PT7-2 and PR0340-3-3-1with the addition of Buster, Merlot, Sierra, and Domino. The major surprise was the higher performance in the non irrigated trial again suggesting that the delayed rainfall was sufficient to produce a successful bean crop.

Expts. 2917 & 2918: Organic Dry Bean Yield Trials

Two 36-entry navy and black trials were conducted on certified organic grower farms under organic production systems, with no fertilizer, no chemical seed treatments or weed or insect control, no harvest aid chemicals using seed inoculated with native Rhizobium to evaluate new breeding lines, and current varieties for potential production under this management system. Weeds were a major problem in test 2917 and part of the plot was damaged by flooding; insect (potato leaf hopper- PLH) damage was observed in both trials. In test 2917, yields ranged in yield from 4.2 to 24.9 cwt/acre with a mean of 15.1 cwt/acre. Variability was high (CV=20.8%) resulting in a LSD value (4.3 cwt/acre) for significance. Only five lines were significantly higher in yield than the test mean and this included the variety, Shania. In test 2918, yields ranged in yield from 6.1 to 18.1 cwt/acre with a mean of 13.3 cwt/acre. Variability was high (CV=18.2%) resulting in a LSD value (2.8 cwt/acre) for significance. Only four lines were significantly higher in yield than the test mean and only one line B11302 was repeated in both tests. Vista was the better navy bean variety and Shania was the better black bean check variety. The non-nodulating check R99 that cannot fix nitrogen yielded less than10 cwt in both tests again suggesting that nitrogen is a limiting factor under this management system. A group of high nitrogen fixating lines derived from Puebla 152 was included, but none of these lines showed potential and the group included the lowest yielding entry B11552 in both tests. Since organic growers may choose to save seed as organic seed is not widely available, resistance to seed-borne CBB would be an important criterion in their selection of bean varieties to grow. A number of the entries in this trial have high levels of resistance to CBB. The trial will be repeated in 2013 with a different mix of breeding lines.

Expt. 2219: Standard Kidney Bean Yield Trial

This 56-entry trial was conducted on the Montcalm Research Farm to compare the performance of standard and new light red kidney (LRK), dark red kidney (DRK) and white kidney (WK) bean varieties from MSU and CDBN under supplemental irrigation (7x total 3.75"). Part of the trial was damaged by flooding which reduced stands in the mid section of the trial, so a representative sample of 50 plants in each plot was harvested to determine yields. Yields ranged from 15.9 to 40.6 cwt/acre with a mean of 27.3 cwt/acre. Variability was moderate (CV=15%) resulting in a large LSD value (5.6 cwt/acre) needed for significance. Eleven breeding lines significantly out-yielded the test mean, including seven WK and 3 DRK lines and the new white kidney variety Snowdon. White kidney lines continue to out-yield red kidney lines in this trial with yields in excess of 35cwt, whereas the highest yielding LRK lines ranked just outside the top group. Varieties that yielded above the test mean included vine DRK Majesty, Red Hawk and Montcalm whereas Clouseau and Chinook LRK and Beluga WK were below the mean. One of the positive aspects of this trial was the high level of resistance to CBB in the higher yielding entries. Eleven of top 15 entries had CBB scores less than 2.0 compared to value of 5.0 for the CELRK check. A number of large seeded fabada types with seed size above 65g were identified and one line K11939 fell in the top group. Since canning quality is vital in kidney beans, only those DRK lines equivalent in canning quality to Red Hawk, LRK lines equal or better than CELRK and WK lines equivalent to Beluga will be advanced in 2013.

Expt. 2220: Standard Bush Cranberry Bean Yield Trial

This 64-entry trial was conducted on the Montcalm Research Farm to compare new and standard bush cranberry bean varieties under supplemental irrigation (7x total 3.75"). Yields ranged from 9.6 to 39 cwt/acre with a mean of 27.3 cwt/acre. Variability was moderate (CV=11.5%) in this 3-rep test and the LSD needed for significance was high (4.3 cwt/acre). Twelve lines significantly out-yielded the test mean, but the overall seed size was generally smaller than the Etna check (60g). CBB was rated on 1-5 scale and ranged from low of 1.3 to high of 5.0 many of the high-yielding lines expressed high levels of resistance and had values less than 2.0. Check variety Etna had a score of 5.0 and yielded at the test mean while Capri yielded below the test mean. The lowest yielding entry UCD0801 from California was not adapted. The trial represented a broad array of genotypes with different genetic background and a wide range in maturity, lodging resistance and yield potential among entries. Only those entries equivalent to Capri in seed size with improved yield, earlier maturity and canning quality will be advanced in 2013.

Expt. 2221: Preliminary Kidney Bean Yield Trial

This 56-entry trial was conducted on the Montcalm Research Farm to compare new and standard bush cranberry bean varieties under supplemental irrigation (7x total 3.75"). Yields ranged from 18.7 to 36.3 cwt/acre with a mean of 27.3 cwt/acre. Variability was moderate (CV=13.6%) in this 3-rep test and the LSD needed for significance was high (5 cwt/acre). Nine lines significantly out-yielded

the test mean and the top entry was Snowdon. The top group included four WK, 3 DRK and one LRK line. The DRK lines were early maturing and showed good dry down a trait not common in DRK seed class. Seed size was generally smaller in many of the top yielding entries with the exception of Snowdon (66g). CBB was rated on 1-5 scale and ranged from low of 1.5 to high of 5.0 indicating that many lines with values less than 2.0 had high levels of resistance. Similar to test 2220, Red Hawk and Montcalm yielded above the test mean, whereas Clouseau and Beluga yielded below the mean. Only those entries with improved yield and equivalent to Beluga and Red Hawk in seed size, earlier maturity and canning quality will be advanced in 2013.

Expt. 2222: Mayacoba Bean Yield Trial

This is the second year of testing this small 5-entry trial on the Montcalm Research Farm to identify potential new bush mayacoba (yellow) bean varieties that might be suited for production in Michigan. Yields ranged from 15.4 to 16.1 cwt/acre with a mean of 15.8 cwt/acre. Variability was high (CV=19.9%) in this 3-rep test and the LSD needed for significance was high (4.8 cwt/acre). As a result no lines significantly exceeded the test mean, largely as the result of high level of CBB infection. The lines under test were more erect than the Myasi check and all produced a significantly larger seed (46 vs. 36 g/100seeds). The low productivity of the lines in the trial underscores the difficulty of identifying a high yielding mayacoba seed for production in Michigan. Only those entries that retain and exhibit a bright yellow seed color under local conditions will be advanced in 2013.

Expt. 2223: National White Mold Variety Yield Trial

This 64-entry trial was conducted at Montcalm to evaluate a range of diverse dry bean varieties and breeding lines for reaction to white mold under natural field conditions. Genotypes included commercial navy and black bean cultivars, elite MSU lines, and new sources of white mold resistance entered as part of the National *Sclerotinia* Initiative (NSI) Nursery. Lines in the National trial were developed at MSU, OSU, CSU, Cornell, NDSU and USDA-WA. Entries were planted in two row plots with two rows of susceptible spreader variety Matterhorn between plots. Supplemental overhead irrigation was applied 9 times for a total of 4.75" to maintain adequate levels of moisture for favorable disease development at the critical flowering period. Natural white mold infection occurred across the entire trial and was extremely severe in certain plots. White mold was rated on a per plot basis on a scale of 1 to 9 based on disease incidence and severity where 9 had 90+% incidence and high severity index. White mold ranged from 18.5 to 99% and pressure was high compared to 2011. The test ranged in yield from 16.1 to 42.9 cwt/acre with a mean yield of 29.1 cwt/acre. Variability was moderate (CV=14.2%), thus a high LSD value (5.6 cwt/acre) was needed for significance. As a result eleven lines significantly out-yielded the test mean and included the new variety, Eldorado, and La Paz pinto varieties. The top group included new pinto 37-2 from USDA-WA for the third year and for the second year the new small red line ND080547 from NDSU was in the top group. Eldorado, top yielder in 2007, 2008 and 2009 continues to demonstrate superior yield performance under white mold pressure with low score (22.2%). For the first time, two GN lines fell in the top group included G08254 under consideration for release, whereas Matterhorn fell below the test mean with a white mold incidence of 66%. Included in trial were entries coded TL and TW that were previously identified as tolerant to white mold and these also continued to show good tolerance and yield potential. As in past years pintos and reds dominated the entries at the top of trial, followed by blacks, navy and pink lines and large seeded kidney were among the lowest yielding in the test.

This was the third year that some of entries in NSI trial yielded above the test mean as many of the standard entries from NSI trial were among the lowest yielding lines in the past. Past experience using low-yielding white mold resistant germplasm as parents has not proved useful in breeding for white mold resistance. Overall the trial confirmed results from previous years (susceptible check-Beryl rated 99% WM) and this trial will continue to be part of the breeding effort to improve tolerance to white mold.

Expt. 2425: Biological Nitrogen Fixation – BNF Yield Trial

A single 130-entry trial was conducted in East Lansing to measure nitrogen fixation and yield of RIL population grown in a low N (0.03%; normal range 0.05-0.1%) site as only those lines that fix more N will produce more yield under these conditions. The black bean population was developed from cross of Zorro with Puebla 152 line selected as a high nitrogen fixer. Yield ranged from 3.5 to 26.5 cwt/acre with a mean of 17.9 cwt/acre. Variability was high (CV=17.5%), and a LSD value of 4.2 cwt/acre was needed for significance. As a result fourteen lines significantly exceeded test mean and these lines exceeded the performance of the Zorro parent and check varieties. The top yielding entry ranked 8th in the same trial in 2011, but none of the other top-ten entries in 2011 repeated in 2012. One unexpected surprise was the presence of R99 in the top group. The trial was severely stressed due to the extreme drought in 2012 (July-Sept rainfall was 5.72" compared to normal 9.6" for the same period); in addition secondary problems of severe spider mite damage in sections of the field, selective feeding by deer and ground hogs exacerbated the problem. These problems are reflected in the low yields and high CV values. At harvest plant biomass was also recorded to measure harvest index (HI). Harvest index ranged from low of 6% in lowest yielding unadapted entries to 40% in higher yielding entries and these values were lower than in past years. The lower yielding entries tended to be late maturing entries combined with viney prostrate types that did not partition into the seed, hence lower HI. There is a strong correlation between HI and yield and results are similar to those observed in the Beancap drought trials 2115 and 2116. Selecting for high yield must be accompanied with partitioning into the seed. Bean lines with enhanced BNF would be useful trait for organic bean producers who cannot apply conventional fertilizers to increase yield.

Early Generation Breeding Material grown in Michigan in 2012

F3 through F5 lines

Navy and Black - 406 lines, 224 SSD
Pinto - 66 lines
GN - 158 lines
Pinks and Reds - 300 lines, 176 SSD
Kidneys (DR, LR, White) - 157 lines
Cranberry (bush, vine) - 193 lines
Yellow Eye – 14 lines

F2 populations

Navy and Black -219 populations
Pinto - 64 populations
GN - 60 populations
Pinks and Reds - 87 populations
Kidneys (DR, LR, White) – 95 populations
Cranberry (bush, vine) – 5 populations

F1 populations: 498 different crosses among ten contrasting seed types.